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Setting reactions and compressive strengths of calcium phosphate cements.

Fukase Y, Eanes ED, Takagi S, Chow LC, Brown WE.

American Dental Association Health Foundation, Paffenbarger Research Center, National Institute of Standards and Technology, Gaithersburg, Maryland 20899.

Setting reactions and compressive strengths of a self-hardening calcium phosphate cement (CPC) were investigated. The CPC consists of tetracalcium phosphate (TTCP) and anhydrous dicalcium phosphate (DCPA). The cement specimens were prepared by mixing 0.7 g of the powder (TTCP 72.9 wt% + DCPA 27.1 wt%) with 0.175 mL of the liquid (25 mmol/L H₃PO₄ and 1.32 mmol/L sodium fluoride). The specimens were removed from the molds at pre-determined time intervals after being mixed, and their compressive strengths were measured. Immediately afterward, the fractured specimens were rapidly frozen in ethanol (-80 degrees C), lyophilized, and examined by powder x-ray diffraction and scanning electron microscopy (SEM). The results showed that (1) hydroxyapatite was the only reaction product; (2) the reaction was nearly completed within four h, during which both the reaction product and compressive strength increased linearly with time, resulting in a strong correlation between the two; and (3) fully set CPC consisted primarily of small rod-like crystals and some platy crystals.

PMID: 2250090 [PubMed - indexed for MEDLINE]

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